

Name of Work: Supply and commission of one 35000 cfm capacity air handling units. The air handling shall at American Center New Delhi.

Brief Description:

The scope of work is as follows:

- (a) Supply of one 35,000 cfm capacity indoor type, double skin pre plasticized floor mounted type air handling units fabricated out of extruded aluminum section. The AHU consisting of supply air inlet, return air inlet, exhaust and fire dampers, cooling/heating coil made of aluminum finned copper tube with 4 row deep coil sections, fan sections imported centrifugal forward curved fan, drive assembly set, motor, 'v' belts, pre cassette type filters 50mm thick, 304/316 S.S drain pan and 35 mm drain pipe, duly insulated with 13mm closed cell linked insulation.
- (b) Test and check the commissioning of the air-handling units with specified parameters after the installation contractor completes the installation and does the commissioning work.
- (c) The contractor should provide three sets of drawings with complete data's and details. The contractor shall proceed to manufacture the product after receiving the approved drawing.
- (d) The installation & commissioning work will be carried out by other contractor through a separate contract.
- (e) Provide one set of as built drawing and Operation, repair and Maintenance manual at the time delivery of AHU

Contractors are advised to go through the attached scope of work & specifications.

Please quote your lump sum price for the entire work including all overheads and local taxes etc.

Note:

This will be a lump sum contract and nothing extra will be entertained on any account.

First phase comprises of supply of air handling units. The second phase comprises testing and commissioning of the equipment. The work to be carried out by professional workers and certified fitter and sheet metal worker in good workmanship and neat manner as per the 1996 SMACNA "HVAC Duct Construction Standards.

The supplier/ manufacturer will arrange for a dedicated full time engineer/supervisor at the time of commissioning of the equipment.

Enclosure:

- 1 Scope of work
- 2 Specifications

Specification of AHU

PART 1 - PRODUCTS

1.1 MANUFACTURERS

- A. Available Manufacturers: **Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:**
- B. Manufacturers: Subject to compliance with requirements, provide products by **one of the following or equivalent to meet the specification:**

Basis of Design: .

- 1. Carrier
- 2. Trane Company (The); Commercial Systems Group.
- 3. Zeco Aircon Industries or equivalent

1.2 MANUFACTURED UNITS

- A. General Description: Factory assembled, consisting of fans, motor and drive assembly, coils, damper, plenums, filters, drip pans, and mixing dampers.
- B. Motor and Electrical Components:
- C. Except as other wise indicated, provide manufacturer's standard products of categories and types required for each application.
- D. Provide Engraved plastic Laminate Labels, Signs and Instruction plate minimum size 130sq.cm. The engrave legend in white letters on black face and punch for mechanical fasteners.

1.3 CABINET

- A. Materials: Formed and reinforced galvanized steel panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed. Units located outdoors shall be treated with a corrosion protective coating and exterior finish.
 - 1. Outside Casing: Steel, **1mm.**
 - 2. Outside Casing: Galvanized steel, **1mm.**
 - 3. Inside Casing: Galvanized steel, **0.7 mm.**
 - 4. Floor Plate: Stainless steel, **2-3 mm.**
- B. Insulation: Coated, glass-fiber insulation, complying with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," for insulation A. Hot Surfaces: Normal operating temperatures of 100 deg F (38 deg C) or higher.
- B. Dual-Temperature Surfaces: Normal operating temperatures that vary from hot to cold.
- C. Cold Surfaces: Normal operating temperatures less than 75 deg F (24 deg C).
- D. Thermal resistivity is designated by an r-value that represents the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch (25.4 mm) thick. Thermal resistivity (r-value) is expressed by the temperature difference in degrees Fahrenheit (Kelvins) between the two exposed faces required to cause 1 BTU per hour (1 Watt) to flow through 1 square foot (1 square meter) at mean temperatures indicated.

- E. Thermal Conductivity (k-value): Measure of heat flow through a material at a given temperature difference; conductivity is expressed in units of Btu x inch/h x sq. ft. x deg F (W x m/sq. m x K).
- F. Density: Is expressed in pcf (kg/cu. m).
- G. Material certificates, signed by the manufacturer, certifying that materials comply with specified requirements where laboratory test reports cannot be obtained.

1.4 **QUALITY ASSURANCE**

- A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.
 - 1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.
 - 2. Exterior Insulation: Flame spread rating of 75 or less and a smoke developed rating of 150 or less.
- B. Access Panels and Doors: Same materials and finishes as cabinet and complete with hinges, latches, handles, and gaskets.
 - 1. Fan section shall have inspection and access panels and doors sized and located to allow periodic maintenance and inspections.
- C. Drain Pans: Formed sections of galvanized steel sheet. Fabricate pans in sizes and shapes to collect condensate from cooling coils (including coil piping connections and return bends) and humidifiers when units are operating at maximum-catalogued face velocity across cooling coil.
 - 1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
 - 2. Drain Connections: Both ends of pan.
 - 3. Pan-Top Surface Coating: Elastomeric compound.
 - 4. Units with stacked coils shall have an intermediate drain pan or drain trough to collect condensate from top coil.

1.5 **FAN SECTION**

- A. Fan-Section Construction: Belt-driven centrifugal fans, consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure, equipped with formed-steel channel base for integral mounting of fan, motor, and casing panels. Mount fan scroll, wheel, shaft, bearings, and motor on structural-steel frame, with frame mounted on base with vibration isolation. At the option of the contractor the motors may be mounted outside the unit.
- B. Housings: Fabricate from formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff, spun-metal inlet bell, and access doors or panels to allow entry to internal parts and components.
- C. Fan Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor power. Fan wheel shall be double-width, double-inlet type with forward/backward-curved blades.

1. Forward Curved: Black steel with enamel or galvanized finish, and having an inlet flange, back plate, shallow blades with inlet and tip curved backward in direction of airflow, and steel hub.
 2. Shafts: Hot-rolled steel; turned, ground, and polished, and having keyway to secure to fan wheel hub.
 3. Shaft Bearings: Pre-lubricated and sealed, self-aligning, pillow-block-type ball or roller bearings with the following:
 - a. Rate Bearing Life: ABMA 9 or ABMA 11, L-50 of 400,000 hours.
 4. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - a. Service Factor Based on Fan Motor: 1.5.
 5. Pulleys: Cast iron or steel with split, tapered bushing, dynamically balanced at factory.
 6. Motor Pulleys: Adjustable pitch, selected so pitch adjustment is at middle of adjustment range at fan design conditions.
 7. Belts: Oil resistant, nonsparking, and nonstatic; matched for multiple belt drives.
 8. Belt Guards: Fabricate to OSHA/SMACNA requirements, 0.1046 inch (2.7 mm) thick, 3/4-inch (20-mm) diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated.
 - a. Provide belt guards for motors mounted on outside of cabinet.
 9. Motor Mount: Adjustable for belt tensioning.
 10. Vibration Control: Install fans on restrained open-spring vibration isolators, minimum 1-inch (25-mm) static deflection, with side snubbers.
- D. Fan-Section Source Quality Control: The following factory tests are required.
1. Sound Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.
 2. Factory test fan performance for flow rate, pressure, power, air density, rotation speed, and efficiency. Establish ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

1.6 BASIC MOTOR REQUIREMENTS

- A. Basic requirements apply to mechanical equipment motors, unless otherwise indicated.
- B. Frequency Rating: 50 Hz.
- C. Voltage Rating: 415 VOLT 3 PHASE to which motor is connected.
- D. Temperature Rating: 50 deg C maximum temperature rise at 40 deg C ambient for continuous duty at full load (Class F Insulation).
- E. Service Factor: 1.15 for polyphase motors
- F. Motor Construction: NEMA MG-1, general purpose, and continuous duty, Design B.

Bases: Adjustable.

- G. Capacity and Torque Characteristics: Rated for continuous duty and sufficient to start, accelerate, and operate connected loads at designated speeds, in indicated environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- H. Enclosure: Open dripproof, unless otherwise indicated.

1.7 POLYPHASE MOTORS

- A. Description: NEMA MG 1, medium induction motor.
1. Design Characteristics: NEMA MG 1, Design B, unless otherwise indicated.
 2. Energy-Efficient Design: Premium efficiency E-type.
 3. Stator: Copper windings, unless otherwise indicated. Multispeed motors have separate winding for each speed.
 4. Rotor: Squirrel cage, unless otherwise indicated.
 5. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
 6. Temperature Rise: Match insulation rating, unless otherwise indicated.
 7. Insulation: Class F, unless otherwise indicated.
- B. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for indicated controller, with required motor leads brought to motor terminal box to suit control method.
- C. Rugged-Duty Motors: Where indicated, motors are totally enclosed with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings are insulated with non-hygroscopic material. External finish is chemical-resistant paint over corrosion-resistant primer.
- D. Source Quality Control: Perform the following routine tests according to NEMA MG 1:
1. Measurement of winding resistance.
 2. No-load readings of current and speed at rated voltage and frequency.
 3. Locked rotor current at rated frequency.
 4. High-potential test.
 5. Alignment.
- E. Bearings: The following features are required:
5. Ball or roller bearings with inner and outer shaft seals.
 6. Grease lubricated.
 7. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
- F. Enclosure Type: The following features are required:
1. Open dripproof motors where satisfactorily housed or remotely located during operation.
 2. Guarded dripproof motors where exposed to contact by employees or building occupants.
- G. Overload Protection: Built-in, automatic reset, thermal overload protection.
- H. Noise Rating: Quiet.
- I. Efficiency: Energy-efficient motors shall have a minimum efficiency as scheduled according to IEEE 112, Test Method B. If efficiency is not specified, motors shall have a higher efficiency than "average standard industry motors" according to IEEE 112, Test Method B.
- J. Nameplate: Indicate full identification of manufacturer, ratings, characteristics, construction, and special features.
- K. Starters, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 16 Sections.

1.8 COILS

- A. Coil Sections: Common or individual, insulated, galvanized steel casings for heating and cooling coils. Design and construct to facilitate removal and replacement of coil for maintenance and to assure full airflow through coils.
- B. Coil Construction: Rigidly supported across full face, pitched to allow drainage.
 - 1. Fins: Aluminum, mechanically bonded to tubes.
 - 2. Tubes: Seamless copper.
 - 3. Coil Casing: Galvanized steel.
 - 4. Headers for Water Coils: Steel, or copper with connections for drain valve and air vent, and threaded piping connections.
- C. Water Coils: Drainable with threaded plugs, serpentine with return bends in smaller sizes and with return headers in larger sizes.
- D. Coil-Performance Tests: Factory-test cooling and heating coils, except sprayed surface coils for rating according to ARI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils."

1.8 DAMPERS

- A. General: Leakage rate, according to AMCA 500, "Test Methods for Louvers, Dampers and Shutters," shall not exceed 2 percent of air quantity at 2000-fpm (10-m/s) face velocity through damper and 4-inch wg (1000-Pa) pressure differential.
 - 1. Damper operators shall be electrically operated. Actuator (make Anergy or Honey well) shall be compatible with BMSSYSTEM (Make: Automatic logic control)
- B. Combination Filter/Mixing Box: Parallel-blade galvanized steel damper blades mechanically fastened to steel operating rod in reinforced, galvanized steel cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously. Cabinet support members shall hold 2-inch- (50-mm-) thick, pleated, flat permanent or throwaway filters. Provide hinged access panels or doors to allow removal of filters from both sides of unit.

1.9 FILTER SECTION

- A. Description: Type >B= - Factory-fabricated, dry, extended-surface filters with holding frames and having performance characteristics as indicated. Provide pre-filters prior to all extended surface filters.
- B. Media: Fibrous material formed into deep V-shaped pleats and held by self-supporting wire frames.
- C. Frame: Nonflammable cardboard, with suitable fasteners and gaskets to hold media and media frame and to prevent unfiltered air from passing between media frames and holding devices.
- D. Filter Section: Provide filter media holding frames arranged for flat or angular orientation, with access doors on both sides of unit.
- E. Ratings: Provide filters with rated face velocity of 2.5 m/s, initial resistance of 75 Pa with 50 to 60 percent ASHRAE 52 efficiency, and 150 Pa with 90 to 95 percent efficiency, and final rated resistance of 300 Pa.

1.1 EXAMINATION

- A. Examine areas and conditions to receive equipment, for compliance with installation tolerances and other conditions affecting performance of central-station air-handling units.
- B. Examine roughing-in of steam, hydronic, condensate drainage piping, and electrical to verify actual locations of connections before installation.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected.
- D.. Electrical: Conform to applicable requirements.
 - 1. Connect fan motors to wiring systems and to ground. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
 - 2. Temperature control wiring and interlock wiring is done others.

1.2 COMMISSIONING

- A. Manufacturer's Field Inspection: **Engage a manufacturer's authorized service representative to perform the following:**
 - 1. Inspect field assembly of components and installation of central-station air-handling units including piping, ductwork, and electrical connections.
 - 2. Prepare a written report on findings and recommended corrective actions.
- B. Final Checks before Startup: Perform the following before startup:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete. Verify that proper thermal overload protection is installed in motors, starters, and disconnects.
 - 3. Perform cleaning and adjusting specified in this Section.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify free fan wheel rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
 - 5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
 - 6. Set outside-air and return-air mixing dampers to minimum outside-air setting.
 - 7. Comb coil fins for parallel orientation.
 - 8. Install clean filters.
 - 9. Verify that manual and automatic volume control, and fire and smoke dampers in connected ductwork systems are in fully open position.
- C. Starting procedures for central-station air-handling units include the following:
 - 1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm.
 - a. Replace fan and motor pulleys as required to achieve design conditions.
 - 2. Measure and record motor electrical values for voltage and amperage.
 - 3. Manually operate dampers from fully closed to fully open position and record fan performance.

1.3 **DEMONSTRATION**

- A. Engage the services of a manufacturer's authorized service representative to train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.